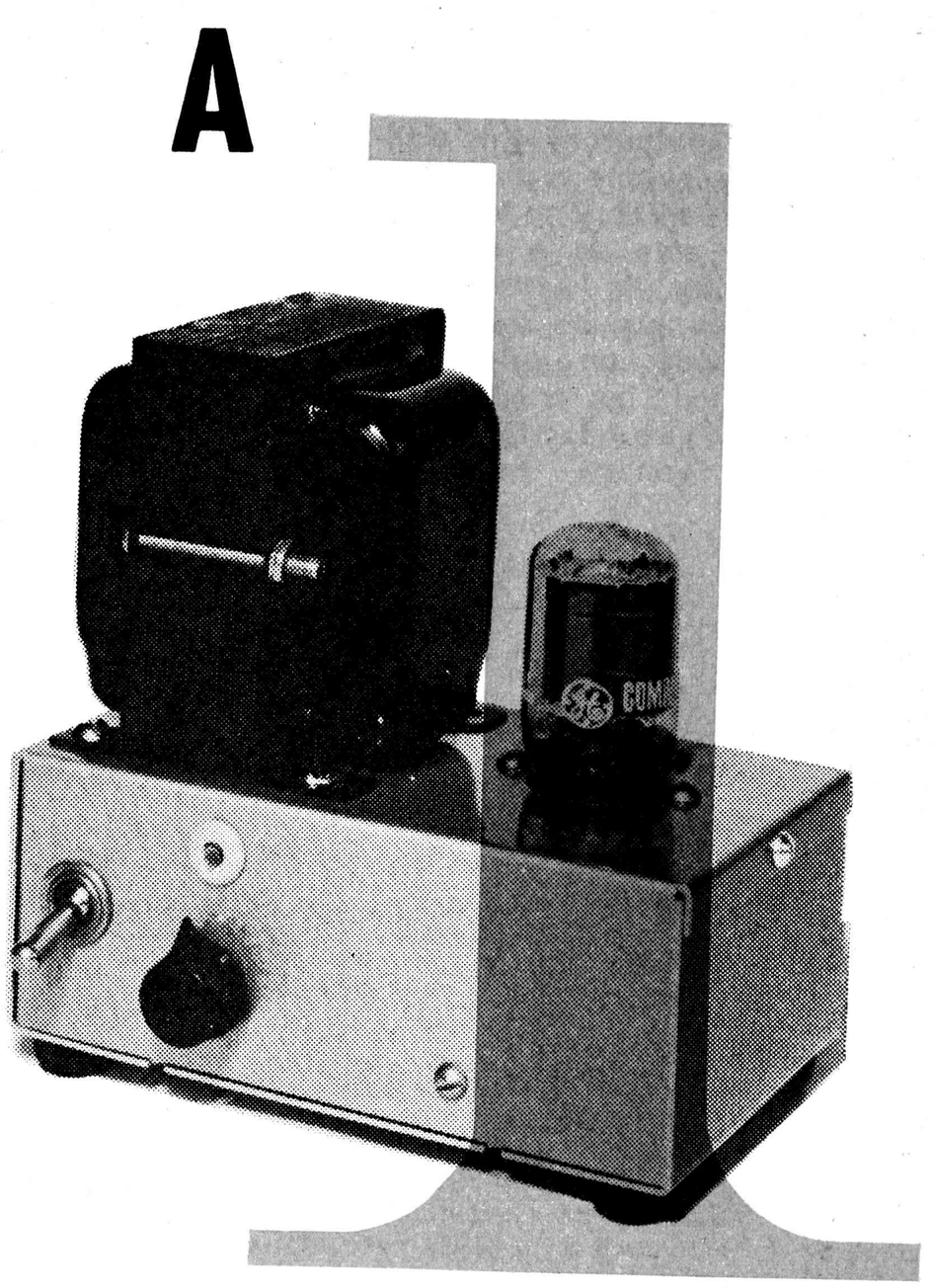
A Compactron Regulated Power Supply

150V TO 250V @ 60mA

POPULAR ELECTRONICS, FEBRUARY 1965

A COMPACTRON REGULATED POWER SUPPLY



By **PHILIP E. HATFIELD,** W9GFS*

Pick your voltages with this simple, economical electronically regulated supply—it's hard to beat

ADJUSTABLE, regulated power supplies for experimental projects, oscillators, and other devices are usually hard to come by. Batteries—one source of reasonably well regulated power—are expensive, and supplies using gas-filled regulator tubes allow for no adjustment of voltage. Electronically-regulated power supplies, the best answer to the problem, are usually multi-tube affairs of considerable complexity. With the circuit shown here, however, you can have an economical, electronically regulated power supply that uses just one tube envelope: a compactron.

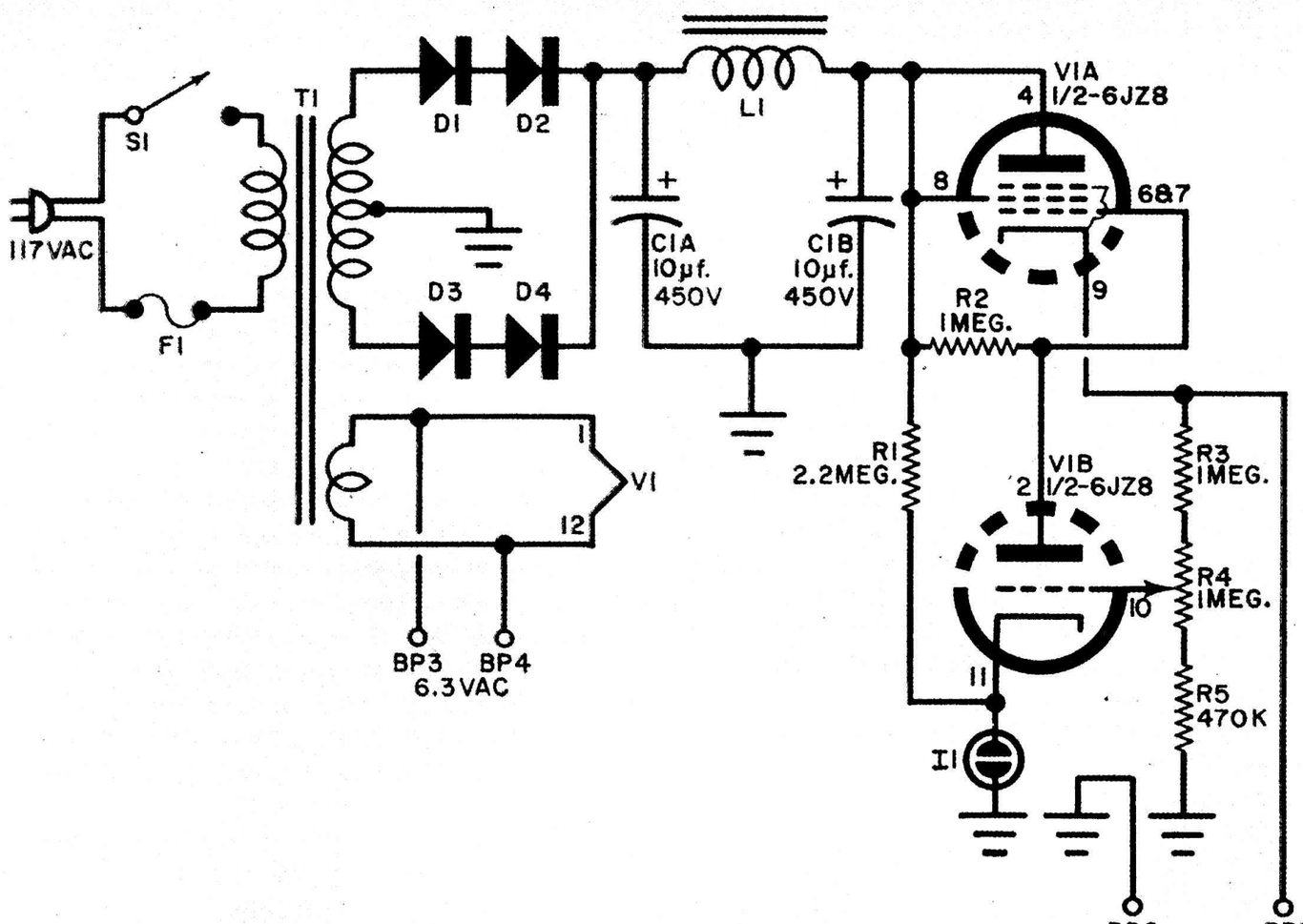
While the supply does not have the capacity or refinements of some of the more elaborate units, its voltage range of 150-250 volts, its maximum output current of 60 ma., and its ability to compensate for normal line-voltage changes make it just the thing for small receivers, converters, and other gear requiring stable plate voltages.

How It Works. Operation of the supply can best be understood by comparing it to a conventional power supply. As soon as we put a load on our unregulated supply, the output drops for several reasons. First, with no load, the filter capacitors charge to the peak voltage of the power transformer, and as we increase the load, we tend to discharge the capacitors faster than we charge them. Secondly, the transformer winding, the rectifier tube, and the filter choke all have resistance; and the more current we draw, the greater the sum of the voltage drops in these components. To compound the problems, the output voltage also goes up and down with the line voltage.

What is needed to compensate for all the above factors is a "potentiometer" in the B-plus line. We can use a vacuum tube as an automatic variable "potentiometer" by placing it in series with the output of the supply and varying its resistance by varying the bias on the grid. We then place a d.c. amplifier between the point where we sample the output voltage and the grid of the tube which is in series with the power supply output.

Finally, we place a gas tube in the cathode circuit of the d.c. amplifier to

*Tube Dept., GE, Owensboro, Ky. Story preprinted from revised edition of GE Hobby Manual.



The output of this full-wave supply is regulated by V1a-V1b. The V1a section acts as a variable resistor in series with the B-plus; its resistance depends on grid bias applied by triode section V1b. Lamp I1 is the voltage reference.

PARTS LIST

BP1 to BP4—"Six-way" binding post
C1—10/10 μf., 450-volt dual electrolytic capacitor
D1 to D4—500-PIV, 600-ma. silicon diode (1N1696 or equivalent)
F1—½-amp type 3AG fuse in fuse holder
I1—NE-2 neon lamp
L1—8-h., 75-ma. filter choke (Stancor C1355 or equivalent)
R1—2.2-megohm, 1-watt resistor
R2, R3—1-megohm, 1-watt resistor
R4—1-megohm potentiometer
R5—470,000-ohm, 1-watt resistor
S1—S.p.s.t. toggle switch
T1—Power transformer: primary, 117 volts a.c.; secondaries, 480 volts @ 70 ma., center-tapped, and 6.3 volts @ 3 amps (Stancor PC-8419 or equivalent)
V1—6JZ8 compactron tube
1—Compactron socket
1—2⅛" x 3" x 5¼" chassis box (LMB 136 or equivalent)
Misc.—Terminal strips, grommets, hookup wire, a.c. line cord, solder, etc.

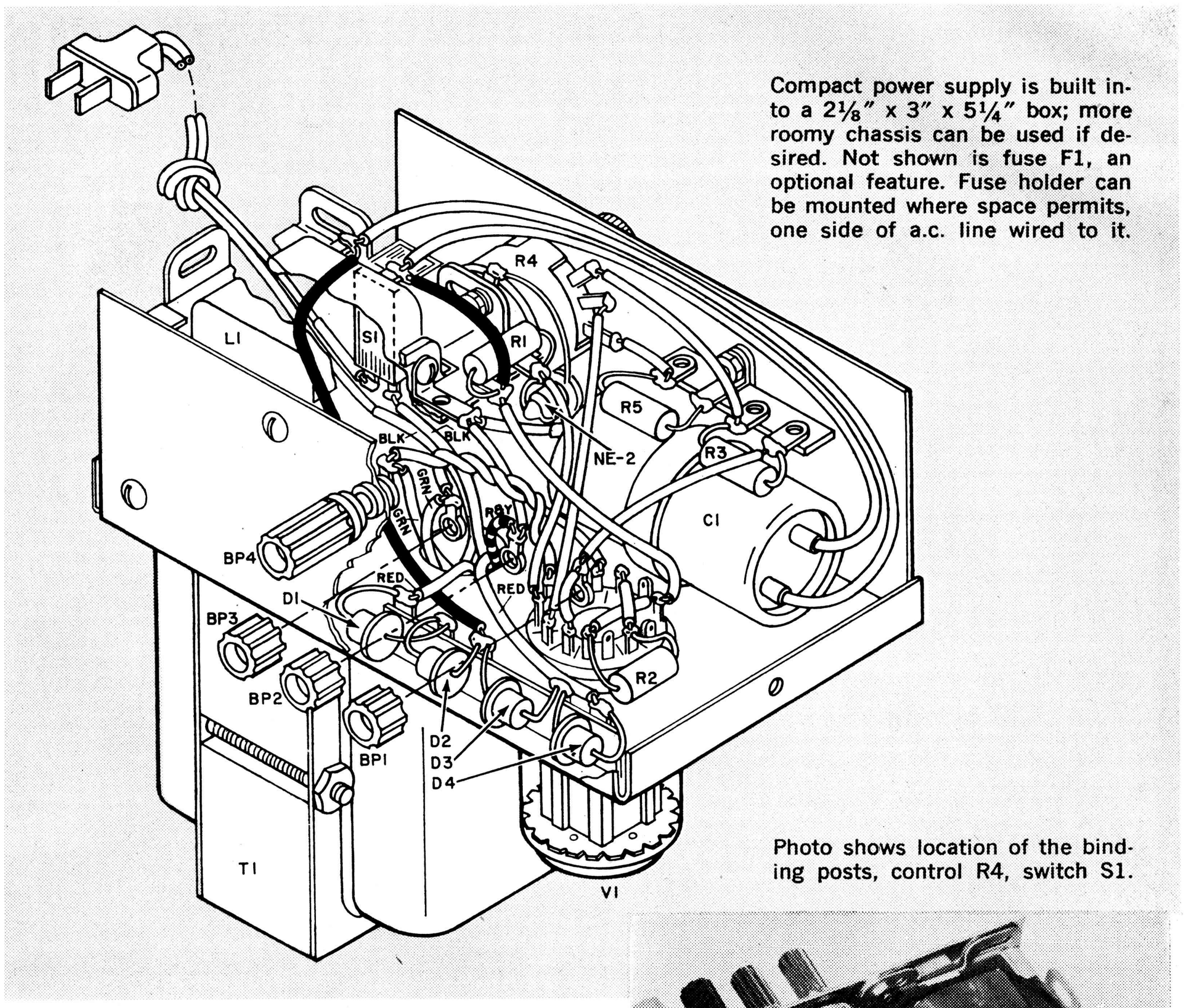
give the amplifier a stable reference voltage for comparison with the power supply output voltage.

Practical Circuit. As shown in the schematic above, the pentode section of a 6JZ8 compactron (*V1a*) is placed in series with the supply output to act as the variable resistor; the triode section of the 6JZ8 (*V1b*) controls the grid bias applied to the pentode. A neon lamp (*I1*) connected in the cathode circuit of the triode, serves the dual purpose of voltage reference source and pilot lamp. The grid of *V1b* is connected to the output voltage of the supply through *R3*, *R4*, and *R5*.

To understand the operation of the regulator, assume that the load on the supply is increased. When this occurs, the output voltage tends to drop for the reasons previously given, and this drop decreases the positive voltage at the triode grid. Since the triode cathode is maintained positive by *I1*, and resistors *R3*, *R4*, and *R5* are proportioned to make the grid somewhat less positive than the cathode, a decrease in positive voltage at the grid increases the bias and causes the plate current of the triode to decrease.

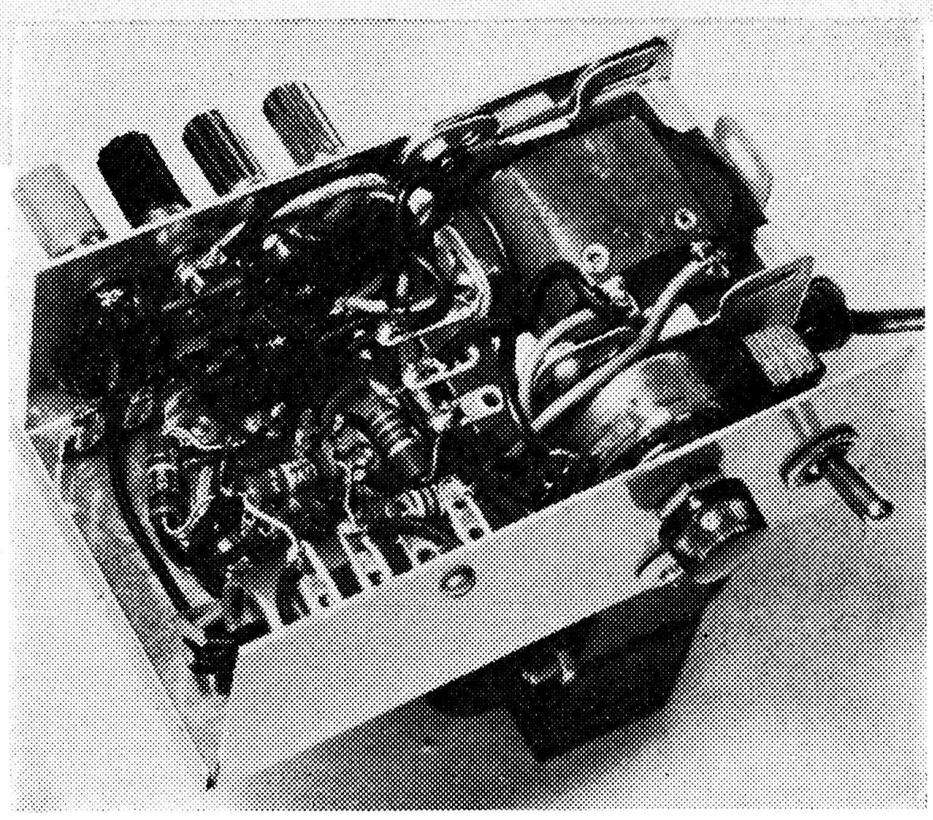
The triode plate current flows through *R2*, and this decrease in current causes the positive voltage at the plate end of *R2* to rise, since there is less voltage drop across *R2* when less current flows through it. The control grid of the pentode is connected to the plate of the triode, and the rise in positive voltage on the pentode grid decreases its grid bias and thus lowers the effective resistance of the pentode. This, in turn, allows the output voltage to rise to the value it had before the load increased. If the load is decreased, the reverse of the foregoing reactions occurs. All of this takes place practically instantaneously.

Construction. Construction of the pow-



Compact power supply is built into a 2⅛" x 3" x 5¼" box; more roomy chassis can be used if desired. Not shown is fuse F1, an optional feature. Fuse holder can be mounted where space permits, one side of a.c. line wired to it.

Photo shows location of the binding posts, control R4, switch S1.



er supply is not particularly difficult, although, as with any piece of gear, components should be installed in proper sequence, and care should be taken to avoid shorts between closely spaced parts. Although a larger chassis can be used, all parts fit neatly in a 2⅛" x 3" x 5¼" box. Mount the transformer on one end of the box, choke *L1* underneath, the binding posts on one side and switch *S1* and control *R4* on the other side. The 12-pin compactron socket is mounted in a hole cut out on the top of the box opposite the transformer. A five-lug terminal strip is used for mounting the four diodes, *D1* through *D4*. Two other terminal strips were used in the prototype unit, one of which is mounted on the side of choke *L1*.

Use a good grade of hookup wire for wiring the unit—preferably the cloth and rubber insulated type. The a.c. line cord is brought into the box through a grommet-lined hole in one end.

Adjustment. The output voltage of the supply may be set to any value between 150 and 250 volts with *R4*. To avoid exceeding the dissipation rating of the 6JZ8, the current drawn from the supply should be limited to 40 ma. at 150 volts, and 60 ma. at 250 volts. With the transformer specified, about 1½ amperes may be drawn from the 6.3-volt terminals to operate the filaments of the tubes in another unit. —30—